FORM PCT 1390 REV. 5/93 U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NO ARTELSMAIR ET AL-1 PCT
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371	U S APPLICATION NO (if known, see 37 CFR 1 5) **09/980957**

INTERNATIONAL APPLICATION NO. PCT/AT00/00158	INTERNATIONAL FILING DATE JUNE 5, 2000	PRIORITY DATE CLAIMED JUNE 4, 1999

TITLE OF INVENTION
METHOD OF DETECTING A WELDING VOLTAGE

APPLICANT(S) FOR DO/EO/US
JOSEF ARTELSMAIR ET AL

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. __X__ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. ____ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. __X__ This is an express request to begin national examination procedures (35 U.S.C. 371 (f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).

4. __X__ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. __X__ A copy of the International Application as filed (35 U.S.C. 371(c)(2)
     a. __X__ is transmitted herewith (required only if not transmitted by the International Bureau)
     b. ____ has been transmitted by the International Bureau.
     c. ____ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. __X__ A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. ____ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
     a. ____ are transmitted herewith (required only if not transmitted by the International Bureau).
     b. ____ have been transmitted by the International Bureau.
     c. ____ have not been made; however, the time limit for making such amendments has **NOT** expired.
     d. ____ have not been made and will not be made.

8. ____ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. ____ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. ____ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. __X__ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. ____ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. __X__ A **FIRST** preliminary amendment.
     ____ A **SECOND** or **SUBSEQUENT** preliminary amendment.

14. ____ A substitute specification.

15. ____ A change of power of attorney and/or address letter.

16. __X__ Other items or information:

     PCT/ISA/210 - Int'l. Search Report (English)

     TWO (2) SHEETS OF FORMAL DRAWINGS

Applicant Claims Priority under 35 U.S.C. §119 of __AUSTRIAN__ Application No. __A 996/99__, filed: __4 JUNE 1999__.
Applicant Claims Priority under 35 U.S.C. §120 of: PCT No. __PCT/AT00/00158__, filed: __5 JUNE 2000__.

APPLICATION NO. (if known, see 37 CFR 1 5) 09/980957	INTERNATIONAL APPLICATION NO PCT/AT00/00158	ATTORNEY'S DOCKET NO ARTELSMAIR ET AL-1 PCT

	CALCULATIONS	PTO USE ONLY

X The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):

Search Report has been prepared by the EPO or JPO......................$890.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) $710.00

Neither international preliminary examination fee paid (37 CFR 1.82) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO........$1,040.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)................$100

ENTER APPROPRIATE BASIC FEE AMOUNT = $ 890.00

Surcharge of **$130.00** for furnishing the oath or declaration later than___ 20 ___ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

Claims	Number Filed	Number Extra	Rate		
Total Claims	12 - 20 =	- 0 -	X **$18.00**	$	
Independent Claims	1 - 3 =	- 0 -	X **$84.00**	$	
Multiple dependent claim(s) (if applicable)		+ **$280.00**		$	
TOTAL OF ABOVE CALCULATIONS =				$ 890.00	
Reduction by 1/2 for Small Entity status, if applicable.				$	
SUBTOTAL =				$ 890.00	

Processing fee of **$130.00** for furnishing the English translation later than___ 20___ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).   + $

TOTAL NATIONAL FEE =	$ 890.00	

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +	See cover sheet attached to assign $ to be charged to Deposit Acct	
TOTAL FEES ENCLOSED =	$ 890.00	
	Amount to be: refunded	$
	charged	$

_____ Applicant claims Small Entity status.

a. **X** A check in the amount of $__890.00__ to cover the above fees is enclosed.

b. ____ Please charge my Deposit Account No. 03-2468 in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. **X** The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Deposit Account No. 03-2468. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

<u>SEND ALL CORRESPONDENCE TO:</u>
COLLARD & ROE, P.C.
1077 Northern Boulevard
Roslyn, New York 11576-1696
(516) 365-9802
Express Mail No. ___EL 871 448 505 US___
Date of Deposit _____December 3, 2001_____

Signature

Edward R. Freedman, Reg. No. 26,048

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10, on the date indicated above, and is addressed to the U.S. Patent and Trademark Office , P.O. Box 2327, Arlington, VA 22202

Lisa L. Vulpis

R:\Vita\Ingrid\Artelsmair et al-1 PCT transm.wpd

<u>PATENT</u>

<u>IN THE UNITED STATES PATENT AND TRADEMARK OFFICE</u>

APPLICANT: JOSEF ARTELSMAIR ET AL

PCT NO.:   PCT/AT00/00158   PCT FILED: 5 JUNE 2000

PRIORITY: A 996/99   PRIORITY FILED: 4 JUNE 1999

TITLE: METHOD OF DETECTING A WELDING VOLTAGE

PRELIMINARY AMENDMENT

ATTN.: BOX PCT APPLICATION
Ass't. Commissioner for Patents
Washington, D.C.   20231

Dear Sir:

    Preliminary to the initial Office Action, please amend the
above-identified application as follows:

IN THE SPECIFICATION:

    On Page 1, line 1, please insert the following paragraphs:

--<u>CROSS REFERENCE TO RELATED APPLICATIONS</u>

    Applicants claim priority under 35 U.S.C. §119 of Austrian

Application No. A 996/99, filed on June 4, 1999. Applicants also

claim priority under 35 U.S.C. §120 of PCT/AT00/00158, filed on

June 5, 2000. The international application under PCT article

21(2) <u>was not</u> published in English.--

On page 1, please replace the first paragraph with the following rewritten paragraph:

--The invention relates to a method of detecting a welding voltage, as outlined in claim 13.--

On page 1, last paragraph to page 2, line 4, please replace with the following rewritten paragraph:

--This objective is achieved by the invention due to the features set out in the characterising part of claim 13. The advantage of this arrangement is that the interference variables can be detected without the need for additional hardware, thereby avoiding any external influences. Another advantage resides in the fact that the calculation method used to determine the interference variables can be run continuously or periodically, which means that in the case of a pulse welding process, a control can be applied during the entire duration of the pulse, making it possible to use or generate very short pulses without having to extract a corresponding range that is not controllable, as is necessary with the prior art.--

On page 2, second complete paragraph to the seventh paragraph, please replace with the following rewritten paragraphs:

--Also of advantage are the features defined in claim 14 which produce a very high welding quality because the interference variables can be taken into account in the process control.

Claim 15 also defines features which are of advantage, since they make it possible to adapt to the control speed or to the requisite welding quality so that welding processes can be run at a very high control rate and to a high welding quality.

The additional features set out in claim 16 are of advantage because they obviate the need for an additional control device for the detection or calculation process and instead this calculation can be operated by the control device used to regulate the process.

Claim 17 offers advantageous features because a standardised structure can be used for the equipment.

The additional features defined in claims 18 to 20 offer advantages because they allow a simple computation model to be used to determine the ohmic resistance and inductance.

Claims 21 and 22 specify advantageous features, as a result of which a computation of the interference variables can also be run during a welding process without having to interrupt the welding process.

Finally, the features outlined in claims 23 and 24 are of advantage because they enable the welding process control to be optimised and offer a simple means of inexpensively improving older welding equipment or welding current sources by means of a software update.--

IN THE CLAIMS:

Please cancel claims 1-12 and replace with new claims 13-24 as follows:

-- 13. Method of detecting welding process voltage (27), wherein the welding process voltage (27) between a welding torch (10) and a workpiece (16) is detected, characterised in that a calculation of the welding process voltage (27) is performed in real time, taking account of the interference variables, in particular an inductance (28) and a resistance (29) of a welding system, in accordance with the formula

$$U_{proc}(t) = U_M(t) - (dI(t) * L) - (I(t) * R)$$

the definition of the formula being as follows:

$U_M(t)$ the instantaneous voltage measured at the welding jacks, in particular at the output terminals 31, 32, by a measuring device 28 via measuring lines 29, 30;

$dI(t)$ the instantaneous change in current;

I(t)   the current measured instantaneously at the welding
        jacks;

R   the resistance 29 determined by a static measuring
        process or preset to a known variable;

L   the inductance 28 determined by a static measuring
        process or calculated during the welding process.

14. Method as claimed in claim 13, characterised in that the
calculated welding process voltage (27) is applied by the
control unit (4) to the welding process control.

15. Method as claimed in claim 13, characterised in that a
calculation process for determining inductance is performed at
specific time intervals during a welding process without the
welding process being affected.

16. Method as claimed in claim 13, characterised in that the
interference variables, in particular the resistance (29)
and/or the inductance (28) of the welding circuit are detected
and/or calculated by the control unit (4) before the start of
the actual welding process.

17. Method as claimed in claim 13, characterised in that a
voltage and a current at the outputs of the current source
(2), in particular at the output terminals (33, 34) of the

current source (2), are measured by a measuring device (30).

18. Method as claimed in claim 13, characterised in that in order to provide a static calculation of the interference variable of the resistance (29) and the inductance (28) of the hose pack (23) and optionally other ohmic interference variables during a secondary short-circuit prior to the start of the welding process, a current change is imposed on a current curve and the measured voltage evaluated.

19. Method as claimed in claim 18, characterised in that at a predetermined point in time of the current curve, a measurement is taken (4) or the values of the voltage and current detected at the output terminals (33, 34) of the current source (2) by the control unit are used to calculate the resistance (29).

20. Method as claimed in claim 18, characterised in that in order to provide a static calculation of the interference variables, in particular the resistance (29) and the inductance (28) of the hose pack (23), the lines of the hose pack (23) are short-circuited or a short-circuit is produced between the electrode of the welding torch (10) and the workpiece (16) with the supply lines (7) of the hose pack (23) connected thereto, taking account of other interference

variables, in particular of the welding torch (10).

21. Method as claimed in claim 13, characterised in that in order to calculate the interference variables during a welding process for a stable state of the welding process, a balancing pulse is modulated onto or imposed on the welding current, after which the detected values are applied for calculation purposes at fixed points in time.

22. Method as claimed in claim 13, characterised in that the electrical behaviour of the arc (15), in particular an arc characteristic curve, is incorporated in the process for calculating the interference variables.

23. Method as claimed in claim 13, characterised in that a process control or a welding process control is performed during the entire pulse duration.

24. Method as claimed in claim 13, characterised in that the interference variables are calculated by the control unit (2) by means of software using the detected values and a predetermined calculation program.--

REMARKS

By this Preliminary Amendment, the application has been

amended to conform with U.S. practice, the cross-reference to the related application has been inserted on page 1. Also, claims 1-12 have been replaced by new claims 13-24. No new matter has been introduced.

Entry of this amendment is respectfully requested.

Respectfully submitted,

JOSEF ARTELSMAIR ET AL

COLLARD & ROE, P.C.
1077 Northern Boulevard
Roslyn, New York 11576
(516) 365-9802

Allison C. Collard, Reg. No. 22,532
Edward R. Freedman, Reg. No. 26,048
Attorneys for Applicants

Method of detecting a welding voltage

The invention relates to a method of detecting a welding voltage, as outlined in claim 1.

Document DE 197 17 462 A1 discloses a method and a switching system for detecting interference variables and determining arc voltage, in which an actual value for the working voltage is reduced to the sum of the partial voltage releases relevant to the actual welding process needed to control the welding current source via the arc and via the end of the electrode through which the welding current flows, so that only the effective resistance values are used for control purposes, without additionally having to involve in the control system any interference variables which influence the control system and hence the transmissibility, comparability, reproducibility, process stability and finally welding quality. In this method, the detected working voltage is transmitted to a welding current source, the working voltage being detected externally to the output terminals of the current source as a sum of the partial voltage releases relevant to the actual welding process via an arc and via an end of an electrode through which the welding current flows, as well as via a resistance of the workpiece, additional measuring lines being provided for the detection process. These are connected to a controller so that the drop in voltage can be measured or detected via these measuring lines.

The disadvantage of this arrangement is that providing additional lines considerably increases the amount of wiring needed for a welding process and the parallel transmission to the welding lines gives rise to extra interference signals which affect the measuring lines and have to be compensated at great technical expense and which can lead to faulty measurements.

The underlying objective of the invention is to propose a method of detecting the welding process voltage, whereby the calculated or detected interference variables of the welding process voltage can be incorporated in the control process without incurring significant expense.

This objective is achieved by the invention due to the features set out in the characterising part of claim 1. The advantage of this arrangement is that the interference variables can be detected without the need for additional hardware, thereby avoiding any external influences. Another advantage resides in the fact that the calculation method used to determine the interference

variables can be run continuously or periodically, which means that in the case of a pulse welding process, a control can be applied during the entire duration of the pulse, making it possible to use or generate very short pulses without having to extract a corresponding range that is not controllable, as is necessary with the prior art.

Also of advantage are the features defined in claim 2 which produce a very high welding quality because the interference variables can be taken into account in the process control.

Claim 3 also defines features which are of advantage, since they make it possible to adapt to the control speed or to the requisite welding quality so that welding processes can be run at a very high control rate and to a high welding quality.

The additional features set out in claim 4 are of advantage because they obviate the need for an additional control device for the detection or calculation process and instead this calculation can be operated by the control device used to regulate the process.

Claim 5 offers advantageous features because a standardised structure can be used for the equipment.

The additional features defined in claims 6 to 8 offer advantages because they allow a simple computation model to be used to determine the ohmic resistance and inductance.

Claims 9 and 10 specify advantageous features, as a result of which a computation of the interference variables can also be run during a welding process without having to interrupt the welding process.

Finally, the features outlined in claims 11 and 12 are of advantage because they enable the welding process control to be optimised and offer a simple means of inexpensively improving older welding equipment or welding current sources by means of a software update.

The invention will be described with reference to an example of an embodiment.

Of the drawings:

Fig. 1   is a schematic diagram of a welding machine or a welding device;

Fig. 2   is simplified, schematic operating diagram of the welding device and welding current circuit.

Firstly, it should be pointed out that the same parts mentioned in the different explanations of the embodiment are denoted by the same reference numbers. The positions chosen for the purposes of the description relate to the drawing specifically being described and can be transposed in terms of meaning to a new position when another position is being described.

Figs. 1 and 2 illustrate a welding system or a welding device 1 for operating a whole variety of welding processes, such as MIG/MAG welding or TIG welding or electrode welding proc-esses. Clearly, the solution proposed by the invention may also be used with a current source or a welding current source.

The welding device 1 comprises a current source 2 with a power component 3, a control unit 4 and a switching element 5 co-operating with the power component 3 and the control unit 4. The switching element 5 or the control unit 4 is connected to a control valve 6, which is ar-ranged in a supply line 7 for a gas 8, in particular an inert gas such as CO_2, helium or argon and similar, between a gas storage 9 and a welding torch 10.

In addition, a wire feed device 11, such as commonly used in MIG/MAG welding, may be ac-tivated via the control unit 4, as a result of which a welding wire 13 is fed via a wire feed line 12 from a supply drum 14 into the region of the welding torch 10. Clearly, the wire feed de-vice 11 could also be integrated in the welding device 1, in particular the basic housing, as is common practice in the prior art, rather than being provided as an additional device in the manner illustrated in Fig. 1.

The current needed to strike an arc 15 between the welding wire 13 and a workpiece 16 is fed from the power component 3 of the current source 2 to the welding torch 10 and the welding

wire 13 via a welding line 17, the workpiece 16 to be welded also being connected to the welding device 1, in particular the current source 2, by another welding line 18, thereby enabling a current circuit to be established across the arc 15.

In order to cool the welding torch 10, the welding torch 10 may be connected to a fluid container, in particular a water container 21, via a coolant circuit 19 with a flow indicator 20 connected in between, so that the coolant circuit 19, in particular a fluid pump provided as a means of conveying the liquid in the water container 21, can be activated when the welding torch 10 is switched on, thereby providing cooling for the welding torch 10 and the welding wire 13.

The welding device 1 also has an input and/or output device 22, by means of which a whole variety of welding parameters and operating modes of the welding device may be set. The welding parameters entered from the input and/or output device 22 are transmitted to the control unit 4, from where the individual components of the welding system or the welding device 1 are activated.

In the example of the welding torch 10 illustrated as an example here, a hose pack 23 is also connected to the welding device 1 or the welding unit. The individual lines from the welding device 1 to the welding torch 10 are disposed in the hose pack 23. The hose pack 23 is connected to the welding torch 10 by means of a connector unit 24 known from the prior art, whilst the individual lines in the hose pack 23 are connected to the individual contacts of the welding device 1 via connector jacks or socket connectors. To ensure that the hose pack 23 is relieved of any tension, the hose pack 23 is connected to a housing 26, in particular the basic housing of the welding device 1, by means of a pull-relief device 25.

In the welding device 1 or welding system illustrated, the process for calculating the interference variables and a welding process voltage 27, schematically illustrated in the region of the arc 15, is integrated in the control unit 4. Since this process is provided in the form of a software programme, no further drawings are provided. However, to enable this process to be run by the control unit 4, the control unit 4 is provided in the form of a microprocessor controller. Clearly, any other type of control unit 4 could be integrated in the welding device 1 as a

means of running software programmes, such as a stored-programme controller, a computer or PC, etc..

For the purposes of the method proposed by the invention, used to determine the welding process voltage 27, in which a real time calculation of the welding process voltage 27 is applied to a welding system and allowance is made for interference variables, in particular an inductance 28 and a resistance 29, the actual welding process voltage 27 which is applied to the welding process control is calculated throughout the entire processing duration by means of the formula

$$U_{proc}(t)=U_M(t) - (dI(t) * L) - (I(t) * R).$$

The definition of the formula is as follows:

$U_M(t)$ the instantaneous voltage measured at the welding jacks, in particular at the output terminals 33, 34, by a measuring device 30 via measuring lines 31, 32;

$dI(t)$ the instantaneous change in current;

$I(t)$ the current measured instantaneously at the welding jacks;

R   the resistance 29 determined by a static measuring process or preset to a known variable;

L   the inductance 28 determined by a static measuring process or calculated during the welding process.

Since the welding inductance, in particular the inductance 28, is susceptible to constant change, particularly in robot systems, it is re-calculated continuously or at specific time intervals during the welding process. To this end, the known resistance behaviour of the arc 15, in other words the electrical behaviour of the arc 15, or the constant resistance is applied during a short-circuit and the current inductance 28 determined by analysing changes in the current and voltage. If a welding process does not involve any process-related changes in current such as would be needed to calculate the inductance 28, a current pulse, which does not affect the welding process, can be modulated on top as a means of calculating inductance in the welding circuit, i.e. in order to calculate the interference variables during a welding process for a stable state of the welding process, a balancing pulse is modulated upon or imposed on the

welding current and the detected values are then applied for calculation purposes at fixed points in time.

The static detection of interference variables, which can be initiated before the actual welding process, is triggered by the user or alternatively by a robot or automaton. To this end, the ends of the positively polarised and the negatively polarised welding line 17, 18, e.g. the contact pipe of the welding torch 10 in MIG or MAG welding and in WIG or electrode welding the electrode holder with the workpiece 16, are short-circuited and the detection of interference variables initiated. The resistance calculation is performed at a constant current at a predetermined point in time, i.e. $dI = 0$, for which purpose a measurement or the detected values of the voltage and current at the output terminals 33, 34 of the current source 2 are used by the control unit 4 as a means of calculating the resistance 29. During this process, a current pulse may be imposed after the resistance calculation, thereby making it very easy to calculate the inductance 28. Since the welding circuit resistance, in particular the ohmic resistance 29, barely changes for a constant system structure, it is only necessary to determine the resistance when the system or the welding unit is switched on or has been fitted with different equipment.

In order to be able to calculate the individual interference variables, the measuring device 30 is disposed in the welding device 1 and is connected to the output terminals 33, 34 of the current source 2 by means of measuring lines 31, 32. The welding lines 17, 18 for the welding torch 10 and the workpiece 16 are connected to the output terminals 33, 34. Consequently, the voltage and the current at the outputs of the current source 2, in particular the output terminals 33, 34, can be detected or measured by the measuring device 30. As schematically illustrated, the current may be measured in particular by a separate current measuring device which picks up the magnetic field built up by the lines through which current is flowing and shapes it into an appropriate voltage signal which is evaluated by the measuring device 30 or the control unit 4 and correlated back to the actual current.

This calculation process has a significant advantage in that no external influences affect the measurement results of the measuring device 30 because very short measuring lines 31, 32 can be used. The user of a welding device 1 of this type does not have to set up any additional wiring for the welding process, ruling out faulty connections or poor contacts.

The various calculation processes stored in the control unit 4 are adapted to the differing process states. The voltage and the current at the output terminals 33, 34 are measured continuously by means of the measuring device 30 and the welding process voltage 27 calculated on a continuous basis, which means that the actual value of the welding process voltage 27 is available at all times.

By running the calculation process, the welding process voltage 27 calculated by the control unit 4 can now be used for the welding process control, thereby producing optimum welding quality. This being the case, formulas needed for the calculation process may be stored in the control unit 4, which is preferably provided in the form of a microprocessor controller.

Because these formulas are stored, the control unit 4 is in a position to compute the individual voltages, in particular the individual partial voltages for the inductance 28 and the resistance 29. By means of the detected or calculated interference variables, compensation for the interference variables can now be incorporated in the control process or in the welding process, i.e. these interference variables are taken into account when regulating the welding process so that a more accurate regulation can be applied. At the same time, because the welding process voltage 27 has been calculated, the actual status at the welding torch 10 and the end of the welding wire with regard to the arc 15 is known and a short-circuit between the welding wire 13 and the workpiece 16 can be picked up more quickly, for example, so that the control unit 4 can resolve the short-circuit rapidly by activating the current source 2 accordingly, simultaneously avoiding weld spatter.

Because the welding process voltage 27 is calculated on a constant basis, any changes in the process sequence can be detected in good time, irrespective of how great the speed of the change in current and the welding circuit inductance are. If, on the other hand, the voltages measured at the output terminals 33, 34 are used as a means of regulating the welding process, the voltage is adjusted to a lower range than is available in the welding process whenever the current drops, i.e. a negative dI. As a result, the control unit 4 is able to detect a short-circuit whenever there is a downward slope, whereupon the process control increases the current even though there is no actual short-circuit in the welding process. In order to avoid this in welding processes known from the prior art, short-circuit detection is not operated in this pro-

cess phase or this process phase is eliminated, which means that if any short-circuits do in fact occur in this phase, they are not detected.

By using the method proposed by the invention, it is possible to operate a process control for the entire duration of the pulse without having to eliminate specific process phases.

Essentially, it should be pointed out that this method is operated by means of software and that software-based control functions can be performed by the control unit 4 in addition, in order to compensate for interference variables or to control the welding process, i.e. the interference variables are calculated by the control unit 4 using software, on the basis of the values detected by the measuring device 30, and a predetermined calculation programme and the accuracy of the result is simultaneously checked by control functions in the software.

It should finally be pointed out that in order to provide a clearer understanding of the solution proposed by the invention, individual parts of the embodiment are illustrated on a disproportionately large scale. Also to provide a clearer understanding of the invention, the interference variables, in particular the inductance 28 and the resistance 29, are schematically indicated in the welding line 17. Individual parts of the combinations of features described above in the individual embodiments may be used in conjunction with other individual features from other examples of embodiments and construed as independent solutions proposed by the invention in their own right.

List of reference numbers

1	Welding device	26	Housing
2	Current source	27	Welding process voltage
3	Power component	28	Inductance
4	Control unit	29	Resistance
5	Switching element	30	Measuring device
6	Control valve	31	Measuring line
7	Supply line	32	Measuring line
8	Gas	33	Output terminal
9	Gas storage	34	Output terminal
10	Welding torch		
11	Wire feed device		
12	Wire feed line		
13	Welding wire		
14	Supply drum		
15	Arc		
16	Workpiece		
17	Welding line		
18	Welding line		
19	Coolant circuit		
20	Flow indicator		
21	Water container		
22	Input and/or output device		
23	Hose pack		
24	Connector unit		
25	Pull-relief device		

Claims

1.   Method of detecting welding process voltage (27), wherein the welding process voltage (27) between a welding torch (10) and a workpiece (16) is detected, characterised in that a calculation of the welding process voltage (27) is performed in real time, taking account of the interference variables of a welding system, in particular an inductance (28) and a resistance (29).

2.   Method as claimed in claim 1, characterised in that the calculated welding process voltage (27) is applied by the control unit (4) to the welding process control.

3.   Method as claimed in claim 1 or 2, characterised in that a calculation process for determining inductance is performed at specific time intervals during a welding process without the welding process being affected.

4.   Method as claimed in one or more of the preceding claims, characterised in that the interference variables, in particular the resistance (29) and/or the inductance (28) of the welding circuit are detected and/or calculated by the control unit (4) before the start of the actual welding process.

5.   Method as claimed in one or more of the preceding claims, characterised in that a voltage and a current at the outputs of the current source (2), in particular at the output terminals (33, 34) of the current source (2), are measured by a measuring device (30).

6.   Method as claimed in one or more of the preceding claims, characterised in that in order to provide a static calculation of the interference variable of the resistance (29) and the inductance (28) of the hose pack (23) and optionally other ohmic interference variables during a secondary short-circuit prior to the start of the welding process, a current change is imposed on a current curve and the measured voltage evaluated.

7.   Method as claimed in claim 6, characterised in that at a predetermined point in time of the current curve, a measurement is taken (4) or the values of the voltage and current detected

at the output terminals (33, 34) of the current source (2) by the control unit are used to calculate the resistance (29).

8.   Method as claimed in claim 6 or 7, characterised in that in order to provide a static calculation of the interference variables, in particular the resistance (29) and the inductance (28) of the hose pack (23), the lines of the hose pack (23) are short-circuited or a short-circuit is produced between the electrode of the welding torch (10) and the workpiece (16) with the supply lines (7) of the hose pack (23) connected thereto, taking account of other interference variables, in particular of the welding torch (10).

9.   Method as claimed in one or more of the preceding claims, characterised in that in order to calculate the interference variables during a welding process for a stable state of the welding process, a balancing pulse is modulated onto or imposed on the welding current, after which the detected values are applied for calculation purposes at fixed points in time.

10.   Method as claimed in one or more of the preceding claims, characterised in that the electrical behaviour of the arc (15), in particular an arc characteristic curve, is incorporated in the process for calculating the interference variables.

11.   Method as claimed in one or more of the preceding claims, characterised in that a process control or a welding process control is performed during the entire pulse duration.

12.   Method as claimed in one or more of the preceding claims, characterised in that the interference variables are calculated by the control unit (2) by means of software using the detected values and a predetermined calculation programme.
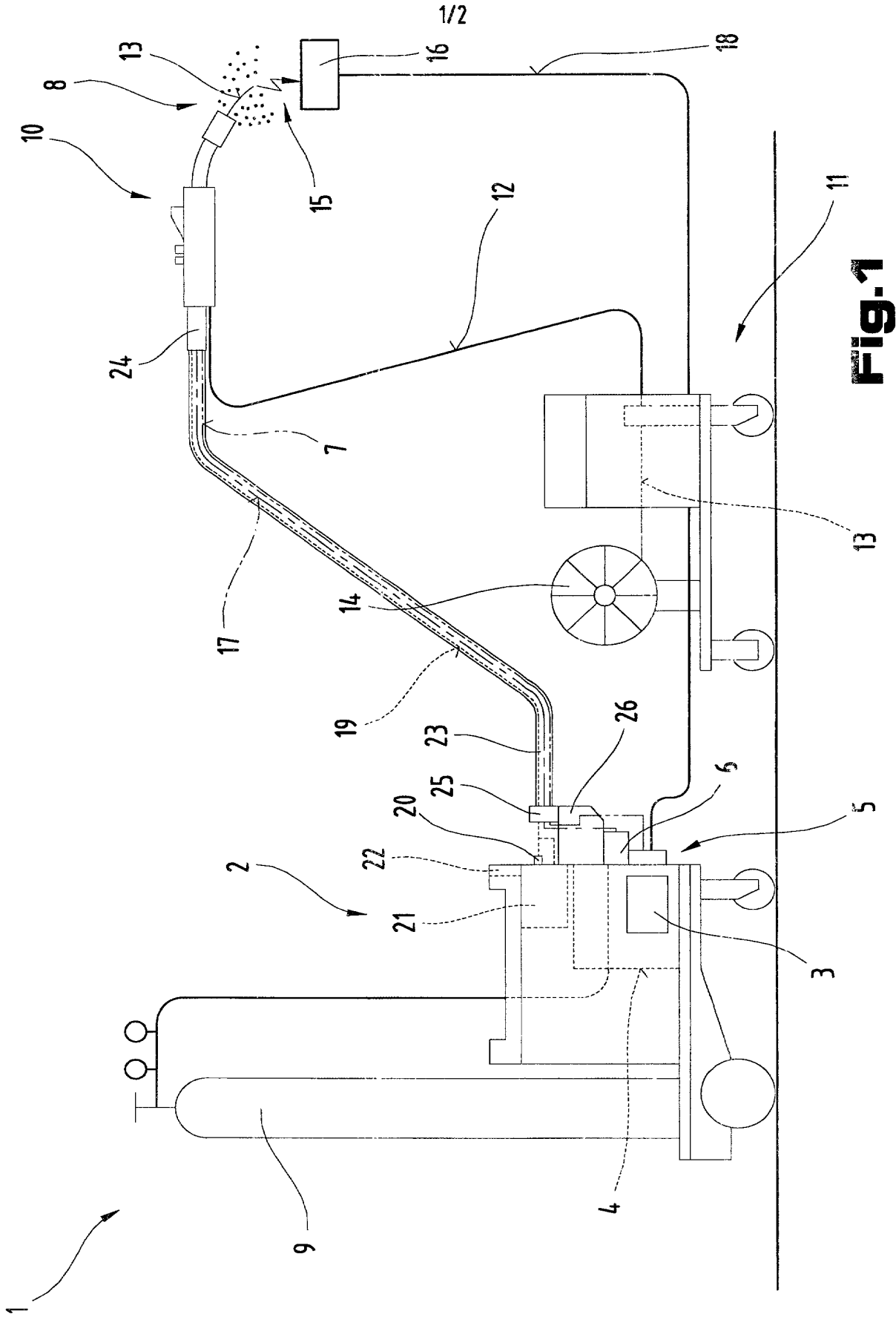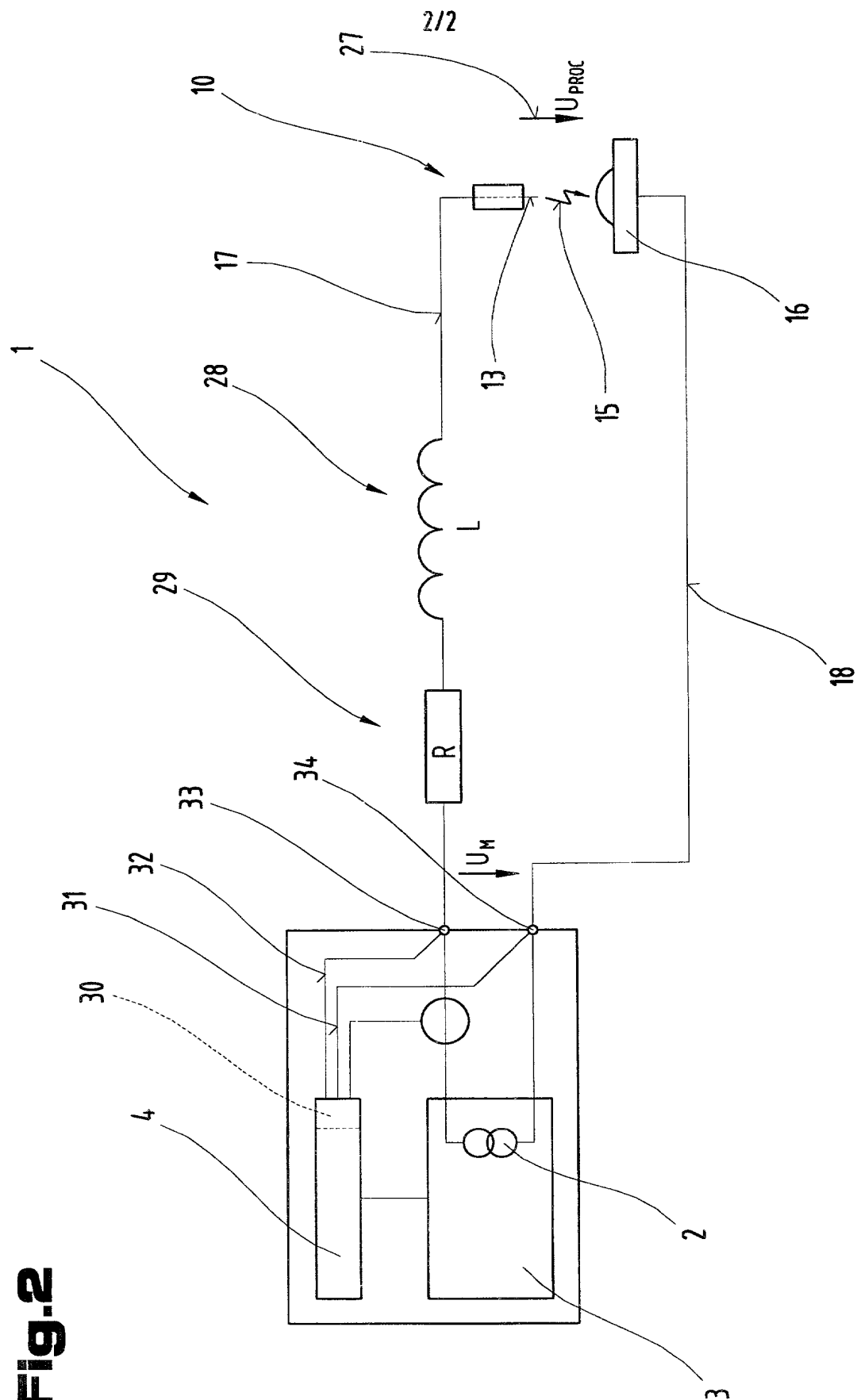
1/2

Fig.1

Fig.2

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS: JOSEF ARTELSMAIR ET AL-1 (PCT)

SERIAL NO.:   09/980,957   FILED: DECEMBER 3, 2001

PCT.NO.:   PCT/AT00/00158   FILED: JUNE 5, 2000

FOR: METHOD OF DETECTING A WELDING VOLTAGE

**RESPONSE TO NOTIFICATION OF MISSING
REQUIREMENTS UNDER 35 U.S.C. §371**

ATTN: BOX PCT
Assistant Commissioner of Patents
Washington, D.C.   20231

Sir:

In response to the enclosed Notification of Missing Requirements dated January 24, 2002, applicants are submitting the Combined Declaration/Power of Attorney and a check for $130.00 for the late fee (Large Entity).

Also attached hereto is an executed ASSIGNMENT, along with the required cover sheet, with authorization to charge the $40.00 to the undersigned attorneys' deposit account.

Any fee deficiencies may be charged to deposit account 03-2468.

Applicant Claims Priority under 35 U.S.C. §119 of Austria Application No. A 996/99 filed June 4, 1999.
Applicant Claims Priority under 35 U.S.C. §120 of: PCT No. PCT/AT00/00158 filed June 5, 2000.

03/27/2002 MGUYEN 00000029 032468 09980957

01 FC:154   130.00 OP

Respectfully submitted,
JOSEF ARTELSMAIR ET AL.

COLLARD & ROE, P.C
1077 Northern Boulevard
Roslyn, New York   11576
(516) 365-9802
ERF/llv

Allison C. Collard, Reg.No.22,532
Edward R. Freedman, Reg.No.26,048
Attorneys for Applicants

Enclosures: Form PCT/DO/EO/905, Executed Declaration/Power of Attorney,
               Check for $130.00, Assignment with cover sheet

EXPRESS MAIL NO. **EL 871 452 181 US**   Date of Deposit March 21, 2002

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10, on the date indicated above, and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Lisa L. Vulpis

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(Includes Reference to PCT International Applications)

| ATTORNEY'S DOCKET NUMBER |

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Method of detecting a welding voltage

the specification of which (check only one item below):

[ ]   is attached hereto.

[ ]   was filed as United States application

Serial No. _____

on _____,

and was amended

on _____ (if applicable).

[X]   was filed as PCT international application

Number   PCT/AT 00/00158 _____

on   5 June 2000 _____,

and was amended under PCT Article 19

on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
Austria (AT)	A 996/99	4 June 1999	[X] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO
			[ ] YES [ ] NO

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (Includes Reference to PCT International Applications)	ATTORNEY'S DOCKET NUMBER

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

_____   _____
(Application Number)   (Filing Date)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclose in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check One)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO.	PCT FILING DATE	U S. SERIAL NUMBERS ASSIGNED (if any)			

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (List name and registration numbers):

KURT KELMAN, Registration No. 18,628   ALLISON C. COLLARD, Registration No. 22,532;
EDWARD R. FREEDMAN, Registration No. 26,048   WILLIAM C. COLLARD, Registration No. 38,411
CHRISTOPHER B. GARVEY Registration No. 31,015   REINE GLANZ, Registration No. 46,728
ELIZABETH COLLARD RICHTER, Registration No. 35,103   FREDERICK J. DORCHAK, Registration No. 29,298

Send Correspondence to:	COLLARD & ROE, P.C. 1077 Northern Boulevard Roslyn, New York 11576	Customer No. 25889	Direct Telephone Calls to: (name and telephone number) (516) 365-9802

FULL NAME OF INVENTOR	FAMILY NAME Artelsmair	FIRST GIVEN NAME Josef	SECOND GIVEN NAME
RESIDENCE & CITIZENSHIP	CITY 4552 Wartberg/Krems	STATE OR FOREIGN COUNTRY Austria	COUNTRY OF CITIZENSHIP Austria
POST OFFICE ADDRESS	POST OFFICE ADDRESS Hiersdorf 59	CITY 4552 Wartberg/Krems	STATE & ZIP CODE/COUNTRY Austria
FULL NAME OF INVENTOR	FAMILY NAME Brunner	FIRST GIVEN NAME Michael	SECOND GIVEN NAME
RESIDENCE & CITIZENSHIP	CITY 8055 Seiersberg	STATE OR FOREIGN COUNTRY Austria	COUNTRY OF CITIZENSHIP Austria
POST OFFICE ADDRESS	POST OFFICE ADDRESS Feldweg 12	CITY 8055 Seiersberg	STATE & ZIP CODE/COUNTRY Austria

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	
DATE 22 January 2002	DATE 22 January 2002	